

PHARMACEUTICAL AND PHARMACOLOGICAL PROFILE OF GUAR GUM AN OVERVIEW

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ABSTRACT

Guar gum is a galactomannan, obtained from plant *Cyamopsis tetragonolobus* (Leguminoceae). It has wide applications in Pharmaceutical formulations, Cosmetic, Food, Textile, Paper, Explosive, Toiletries industries etc. In pharmaceuticals, it is used as tablet binder and disintegrant, suspending, thickening and stabilising agent, as a controlled release carrier. Chemically guar gum is a hydrocolloidal polysaccharide composed of sugar galactose and mannose in molecular ratio of 1:1.4-1:2. Therapeutically it is used as hypoglycaemic, hypolipidemic, antimicrobial, antiproliferative, appetite suppressant, bulk forming laxative, in colitis and Crohn's disease etc. The present review renders elaborate potential data on the range of pharmaceutical, chemical, pharmacological and various industrial applications of guar gum.

Keywords: Guar gum, *Cyamopsis tetragonolobus*, Galactomannans, Pharmaceutical applications.

INTRODUCTION

Guar gum is obtained by ground endosperm of *Cyamopsis tetragonolobus*. It is native to the Indian subcontinent and used as a green vegetable. Guar gum, a natural gum, is an edible thickening agent extracted from the guar bean. Guar beans have a large endosperm which contains galactomannan gum which forms a gel in water. This is commonly known as guar gum and is widely used in food and industrial applications. Guar gum has also proven as a useful substitute for locust bean gum. It is mainly used as a natural thickener, emulsifier, stabilizer, bonding agent, hydrocolloid, gelling agent, soil stabilizer, natural fibre, flocculants and fracturing agent. It is white to yellowish white, nearly odourless powder with bland taste. It is practically insoluble in organic solvents. In cold or hot water, guar gum disperses and swells almost immediately to form a highly viscous thixotropic sol [1].

Method of Manufacture and Pharmaceutical Profile

The endosperm of guar plant is soaked in water or sulphuric acid. Then it is grind to remove seed hull. The final grinding is done as per the required particle size. It contains about 80 % of galactomannan.

Acryloyl guar gum and its hydrogel were synthesized as a carrier for slow release of L-3,4-dihydroxyphenylalanine (L-DOPA) and L-tyrosine which was characterized by Scanning Electron Micrography (SEM), FTIR Spectroscopy and Swelling studies [2]. The thermogelation behaviour of whey protein was analysed at concentration of 3.0 wt%. The results of the study showed that at very low optimum concentration of guar gum, there is a large enhancement in gel strength was observed by compression testing, oscillatory rheology and differential scanning calorimetry.[3].

Size dependant hydration indices, a new model was used for studying effect of particle size on hydration kinetics of guar gum.[4]. Surface hydrophobicity of commercial canola protein isolate and hydrocolloid prepared by j-carrageenan and guar gum were investigated. The results revealed that there is an increase in ability to adsorb at oil-water or air-water interface due to presence of hydrophobic patches on protein surface [5].

Guar gum was used as a carrier for oral controlled drug delivery system. A water soluble drug metoprolol tartarate was formulated into three layered matrix tablet. The results of the study indicate that guar gum is a potential hydrophilic carrier for oral controlled drug delivery system. [6]. The hydrogel prepared by chemical network based on guar gum cross-linked with glutaraldehyde appears to be a suitable matrix for modified drug delivery when characterized by dynamo-mechanical and rheological parameters [7].

In vivo release of guar gum based three layered matrix tablets of Trimetazidine dihydrochloride were evaluated in six healthy volunteers. The bioavailability profile showed that there is a constant and minimum fluctuation in drug delivery was observed [8]. The swelling behaviour and network parameter of guar gum/poly (acrylic acid) semi-interpenetrating poly network hydrogel was studied using free radical polymerization. The increase in guar gum content in hydro gel decreases the swelling ratio while increase in acrylic acid content led to increase in swelling ratio [9].

A novel colon targeted oral drug delivery system for 5-fluorouracil using guar gum as a carrier was developed. The result shows that compression coated tablets containing 80% guar gum provides targeting local action in colon [10]. The rheological properties of aqueous solution of guar gum and hydroxyethyl guar gum have been investigated for zero shear rate, viscosity, elasticity modules and relaxation time. The study indicates that aqueous solution of hydroxyethyl guar gum and guar gum possesses high degree of pseudoplasticity [11].

Guar gum was found to protect drug released from mouth to colon transit when evaluated as a compression coat for colon targeting drug delivery system [12]. The guar gum was found to be a potential carrier for colon specific drug delivery system when invitro evaluated using indomethacin [13]. The guar gum/poly (N-isopropyl acryl amide) interpenetrating polymer network hydrogel (GG/PNIPA Am IPN) were synthesized from NIPAAm in GG aqueous solution via redox radical polymerization in presence of cross linkers. The introduction of GG component with IPN technology could improve temperature sensitivity and permeability of colon specific drug delivery system [14].

The evaluation of viscoelasticity of chemical cross-linked guar gum was investigated. A power-law frequency dependence of the dynamic storage modules and loss modulus was observed at gel point [15].

Chemical Profile

A Novel Guar gum based polycarboxylate hydrogel for water technologies were synthesized by controlled acid hydrolysis and a clean and effective NOx oxidant system. The hydrogel was found to be effective Cu++ sorbents [16]. The commercial guar gum was purified and characterized for biological applications by different methods. All purification methods reduce the protein and mono/ oligo / polysaccharides contaminants [17].

Partially carboxymethylated guar gum grafted with 4-vinylpyridine has been synthesized by employing efficient redox pair. The thermal analysis data shows that the grafted partially carboxymethylated guar gum is thermally more stable with good swelling, metal ion sorption and flocculating properties than ungrafted partially carboxymethylated guar gum [18]. Free radical degradation of guar gum by thermal as well as microwave mediated degradation into lower molecular weight fragments was studied. It was shown that guar gum can be degraded into lower molecular weight fragment by these mediators having better film forming properties [19].

The cross linking of guar gum with glutaraldehyde leads to gurgel with viscosity 40 times higher than original gum viscosity with thermal stability [20]. Rheological properties of Carbomethyl guar gum prepared with acrylamide in presence of sodium hydroxide under different conditions were investigated. The results revealed that carbomethylation shows non-newtonian pseudoplastic behaviour. [21]. The effect of lithium, sodium, potassium, and cesium chlorides on the properties of dilute guar gum solutions was investigated through viscosity measurements. The results of the study showed that the intrinsic viscosity of guar gum is not significantly affected by the salts up to an electrolyte concentration of 4.1 mol/L [22].

Pharmacological Profile

Partially hydrolysed guar gum possesses hypoglycaemic effect by decreased post prandial blood glucose and glucose absorption from small intestine luminal digesta of rat [23]. The efficacy of granulated guar gum was studied in patients with severe hypercholesterolemia over a period of 34 weeks. The results of the study indicate that guar gum was found to be an effective and useful agent for long term treatment of hypercholesterolemia [24].

Influence of long term consumption of dietary fibre, guar gum and cellulose upon metabolic parameters in both diabetic and controlled adult Chinese hamster was studied. The metabolic profile suggests that guar gum consumption contributes to better long term control in severely diabetic, non-insulin dependent adult Chinese hamsters [25]. Guar gum and low molecular weight pectin's causes decrease in corticosteron and insulin levels when investigated on rats over a period of three weeks [26].

The hypolipidaemic effect of guar gum was studied in patients with primary hyperlipidaemia over a period of six weeks. The results revealed that the LDL and plasma cholesterol levels were found to be low as compared to controlled group [27]. Effect of partially hydrolysed guar gum on fecal output in human volunteers was investigated over a period of four weeks. The fecal weight and output frequency were found to be more while pH was found to be low [28].

Short chain fatty acid fermented in cecum of rats fed guar gum diet causes hypoglycaemic effect [29]. A double-blind study in Twenty-nine hypercholesterolaemic patients for a period of one year suggests that Guar gum and Gemfibrozil were found to be an effective combination in the treatment of hypocholesterolemia [30]. Guar gum C-glycosylated derivatives obtained by chemical modification of guar gum were found to have anti-inflammatory and anti-proliferative activity [31]. Guar gum was found to have potential in decreasing serum cholesterol by enhancing cholesterol elimination as fecal bile acids [32].

The effect of guar gum on mineral absorption was assessed by mineral excretion pattern. The result shows that the fecal excretion was significantly decreased with increase in guar gum content [33]. Liquid diet with partially hydrolyzed guar gum improves the gastro intestinal tolerance and bowel control in long term enterally fed patients [34]. Methanolic fraction of saponin rich extract of guar meal was found to have potential haemolytic and antimicrobial activity against *Salmonella typhimurium* and *E coli*. Guar meal was

found to be effective against *Eimeria tenella* infection in boiler chicks [35].

Stability and Storage Condition

Aqueous guar gum dispersions have a buffering action and are stable at pH 4-10.5. The bacteriological stability of guar gum dispersion may be improved by addition of mixture of 0.15% methyl paraben and 0.02% propyl paraben as preservatives. It should be stored in well closed container in cool and dry place [1].

Adverse Effects and Precautions

Guar gum may cause gastrointestinal disturbances with flatulence, diarrhoea and nausea. It should not be used in patients with dysphagia, oesophageal disease or intestinal obstructions [36]. But usage of guar gum in drug delivery applications is well established [37 -41].

CONCLUSION

Guar gum is an important source of nutrition to human and animals are the legume, it regenerates soil nitrogen and the endosperm of guar seed is an important hydrocolloid widely used across a broad spectrum of industries. There are more than 300 applications of guar gum. Guar gum is Generally Recognized as Safe (GRAS) with differing percentages set for its allowable concentration in various food applications. Guar gum has historically been considered acceptable as a food, cosmetic, and supplement additive at Whole Foods Market when used according to FDA regulations and in accordance with Good Manufacturing Practices. Guar Gum and its derivatives are widely used in various industries as per its needs. India's production contributes to 80% of the world's total production figuring up to 6 lakh tons. Synthetic derivatives of guar gum such as guar acetate, guar phthalate, guar acetate phthalate, oxidized guar gum and sodium carboxymethyl guar have also been investigated for their pharmaceutical applications. The continuous study and research are going on and still more focus is needed to invent its novel application for various sectors.

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